Calvert Cliffs Nuclear Power Plant
Constellation Generation Group, LLC

1650 Calvert Cliffs Parkway
Lusby, Maryland 20657

Constellation Energy Group

May 2, 2005

U.S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit No. 1; Docket No. 50-317; License No. DPR 53
Licensee Event Report 2005-002
Reactor Scram Due to Main Turbine Vibrations During Power Reduction

The attached report is being sent to you as required by 10 CFR 50.73. Should you have questions regarding this report, please contact Mr. L. S. Larragoite at (410) 495-4922.

Very truly yours,

David A. Holm
Plant General Manager

DAH/ALS/bjd

Attachment: As stated

cc: R. V. Guzman, NRC
S. J. Collins, NRC
Resident Inspector, NRC
R. I. McLean, DNR

IE22

NRC FORM 366 (6-2004) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 06/30/2007

Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Calvert Cliffs Nuclear Power Plant, Unit 1	05000 317	1 OF 004

4. TITLE
Reactor Scram Due to Main Turbine Vibrations During Power Reduction

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
										05000
03	01	2005	2005	- 002 -	00	05	02	2005	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE
1

10. POWER LEVEL
015

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: *(Check all that apply)*

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☐ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☒ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☐ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER

Specify In Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
A. L. Simpson, Senior Engineer	410-495-6913

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	TA	TRB	G080	Y					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On March 1, 2005 during a planned Unit 1 power reduction to Mode 2 for performance of maintenance on 11 Moisture Separator Reheater drain tank vent line piping, a manual reactor scram was initiated from 15 percent power. An automatic turbine trip followed the manual reactor scram as designed. The reactor was manually scrammed per Abnormal Operating Procedure-7E "Main Turbine Malfunction," when bearing number 5 exceeded 12 mils vibration. The excessive vibration was due to rotor bowing caused by friction heat developed during rotor rubbing. The rubbing most likely developed because the packing to rotor clearances were tight and the steam path was subjected to temperature transients causing shell thermal distortions. Corrective actions include review of previous turbine roll ups/shutdowns for rub levels and rub locations, and incorporating lessons learned from this event into the appropriate operating instruction.

The turbine was placed on turning gear during the maintenance outage and was returned to service without problems. The Unit 1 reactor was restarted and paralleled to the grid on March 2, 2005 at 10:30 am.

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17. NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)*

I. DESCRIPTION OF EVENT

On February 28, 2005, a power reduction to Mode 2 was commenced on Unit 1 for performance of maintenance to replace the vent line piping on 11 Moisture Separator Reheater drain tank. During the power reduction, a rub was initiated on the "B" rotor which led to an elevated vibration level on the bearing number 5 (south end of "B" rotor). The rub was first noticed at about 600 MWe and appeared to be located in the end packing of the "B" rotor hood assembly. Plant personnel had anticipated the possibility of a rub and consulted with the vendor, General Electric for recommendations. A vibration specialist was assigned to consult with plant personnel during the power reduction.

As the power reduction was continued, vibration on bearing number 5 reached 7 mils, so Abnormal Operating Procedure (AOP)-7E "Main Turbine Malfunction," was entered due to the elevated vibration. Operations personnel continued to reduce power on the unit while the vibration specialist analyzed the rub. It was determined that the best option was to continue to downpower the unit and remove the turbine from the grid. When turbine load reached approximately 100 MWe, the vibration level reached approximately 11 mils and was continuing to rise. Operations personnel were able to reduce the reactor power to approximately 15 percent with the loss of load trip automatically bypassed on one of four channels of the Reactor Protective System (RPS). At this point, the vibration on the bearing number 5 reached 12 mils and the reactor was manually scrammed as prescribed in AOP-7E Section V "Excessive Vibration".

The turbine was placed on turning gear during the maintenance outage and was returned to service without problems. The Unit 1 reactor was restarted and paralleled to the grid on March 2, 2005 at 10:30 am.

II. CAUSE OF EVENT

Investigation indicates that most likely the "B" low-pressure (LP) rotor developed a rub in the south end packing. This thermally unstable rub continued to grow as the unit's power was reduced and the resultant vibration eventually reached trip criteria just prior to having the required three of four RPS channels loss of load trip automatically bypassed. With the required three of four RPS channels loss of load trip automatically bypassed, only a turbine trip would have occurred, and not a reactor trip.

During the 2004 refueling outage, the original Unit 1 "Built-Up" LP rotors were replaced with "Monoblock" rotors. "Monoblock" rotors are manufactured from a solid forging that has "wheels" machined as part of the forging. The wheels are the part of the rotor to which the buckets are attached. There are many more places for rubs to occur on "Monoblock" rotors than on "Built-Up" rotors. Rotor rubbing occurs when turbine/generator rotating and stationary components contact while the turbine is turning. The result of rubbing is localized hot spots on the rotor's surface at the point of contact. The heat of friction developed during a rub causes the

rotor material directly under the point of contact to expand compared with the rest of the rotor. This uneven material expansion causes thermal distortions resulting in rotor bowing. As a rotor bows, its centerline of mass and center of rotation move relative to each other resulting in changes in rotor vibration.

The rubbing most likely developed because the packing to rotor clearances were tight and the steam path was subjected to temperature transients causing shell thermal distortions. Some rubbing may be expected during initial operation after an outage when the unit is being operated under a variety of conditions, but light rubbing may occur during any turbine roll, or even during steady-state conditions despite optimal procedures and thermal conditions until the required clearance has been established.

There will be no physical changes to the unit or clearances due to the fact that rubs are an expected event following installation of new turbine/generator rotating and stationary components.

III. ANALYSIS OF EVENT

The manual scram of the Unit 1 reactor was initiated to protect the main turbine and generator, due to high main turbine vibration. All other parameters were normal for the reactor scram and all alarms that were received during the transient were expected. There were no actual nuclear safety consequences incurred from this event. Combined core damage probability was calculated as 2.3E-06.

This event resulted in valid actuation of the RPS, and the actuation was not part of a pre-planned sequence during testing or reactor operation. Therefore, this event is reportable in accordance with 10 CFR 50.73(a)(2)(iv)(A). Immediate notification of this event (Event Number 41452) was made on March 1, 2005 in accordance with 10 CFR 50.72(b) (2) (iv) (B).

IV. CORRECTIVE ACTIONS

A. The turbine was placed on turning gear to remove the bow on the rotor during the maintenance outage and the unit was returned to service without problems.

B. Reviewed previous turbine roll ups/shutdowns for previous rub levels and rub locations to determine if the rub experienced during this event was a repeat rub. It was determined that the rub was not a repeat rub.

C. Incorporate appropriate industry best practices and lessons learned from this event into plant procedures.

D. Provide procedural guidance to Operations personnel that allows an earlier determination of shutdown options based on turbine performance during a unit downpower/shutdown.

V. ADDITIONAL INFORMATION

A. Component Identification

Component	IEEE 803 EIIS Function	IEEE 805 System ID
Main Turbine	TRB	TA

B. Previous Occurrences

A review of Calvert Cliffs' events over the past several years was performed. No previous occurrences were identified involving a reactor scram due to high main turbine vibrations caused by rotor bowing.